Chronic pain affects one in five Americans, making it one of the most common chronic conditions in the United States. Even though millions are affected by chronic pain, there are a limited number of pain therapeutics available to treat this condition. Only 2% of pain therapeutics receive FDA approval from Phase 1, compared to 10% of therapeutics for other diseases. Outcomes are low for the pain field because there is a mistranslation of pain behavior in the pre-clinical stage.

The goal of this study is to improve the way pain is measured in rodents. A previous 2019 publication by Dr. Nathan T. Fried utilized slow-motion videography and statistical modeling to analyze hind paw withdrawal caused by painful stimuli. Upon reanalyzing the one-second slow-motion videos from his study, there was more data in the facial features of the rat, which was not characterized in his work. A 2011 study performed in Dr. Jeffrey Mogil's lab led to the development of the Rat and Mouse Grimace Scales (RGS, MGS), which measure facial features of pain in these rodents. However, their measurement using the Grimace Scale relied on 30 minutes of video analysis.

This project further applies the RGS to the one-second slow-motion videos to assess facial rat grimace in response to different painful stimuli.

University of Pennsylvania provided the one-second slow-motion videos used in this pilot study. These videos captured the pain responses of 10 saline-sired rats when affected by seven stimuli: Cotton Swab, Dynamic Brush, Heavy Pinprick, Light Pinprick, Von Frey 10g (VF 10g), Von Frey 100g (VF 100g), and Von Frey 300g (VF 300g). The Rat Grimace Scale (RGS) was utilized to score five facial features of pain (Whisker Change, Ear Position, Cheek Bulge, Nose Bulge, and Orbital Tightening) on a scale from 0 (not present) to 2 (obviously present).

The overall average RGS score and average RGS score for each facial feature of pain reflect the differences between painful and nonpainful stimuli. The Cotton Swab and Dynamic Brush did not induce a significant pain response in the rats. The Heavy Pinprick resulted in the highest average RGS score for each facial feature.

However, some difficulty was faced when utilizing the RGS to score the one-second slow-motion videos. The reference images for the three scores for each facial feature of pain were not fully distinguishable from one another. This may have led to unintentional bias when scoring the videos. Lower scores may have been given to videos involving the Cotton Swab and Dynamic Brush, while higher scores may have been given to the Heavy Pinprick videos.

Also, the skills needed to score these videos are still in development. With increased training, these videos can be scored more accurately.

Facial rat grimace of saline-sired rats in the one-second slow-motion videos can be assessed with the Rat Grimace Scale.

Future research will involve continued characterization of facial features of pain in saline-sired rats. The scoring of these videos will require the assistance of other undergraduate students, who will be trained in utilizing the RGS. After training them, they will be blinded to the stimuli present in the videos to prevent bias and ensure accurate scoring.

Future projects will also use the RGS to score facial grimace in morphine-sired rats and the MGS to score grimace in mice.

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